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# Adaptation of APOTHECARIES' WEIGHTS AND MEASURES TO THE METRIC SYSTEM.

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# ADAPTATION OF APOTHECARIES' WEIGHTS AND MEASURES TO THE METRIC SYSTEM.

The extension of the decimal monetary system is carrying with it the decimal system of weights and measures. The measure of quantity is inseparable from the measure of value; the standard of one is based upon the standard of the other—that is, so long as a standard of value is expressed in a certain weight of money-metal: gold or silver.

That these two systems should be concordant is indisputable; that trade in this particular will follow science is already becoming evident when even the ultra conservative old-lady-of-Thread-Needle-street—the Gibraltar of the traditional bi-fractional systems of money and measures—is fearful of loss of international trade and prestige because of her adherence to the incongruous collections of arbitrary standards derived by chance and descended through periods of medieval crudescence.

The twentieth century sees decimal systems adopted by every country of consequence save England and with the metric weight and measure system adopted by the United States in conformity with our decimal system of money, the United Kingdom will soon have to fall into line, *nolens volens.*

Decimal systems will supervene because of our decimal system of numeration whatever advantages may be apparent in other systems. The number 10 adopted in the dawn of civilization as the radix of the numerical scale, makes the acceptance of any other system: octonary, duodecimal, or

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vigintal, only "the fitful fancy of an iridescent dream."

While the French system is a modified vigintal system in expression, who would prefer it to the decimal or centesimal system for simplicity, euphony or accuracy? Who would, for example, write: four-times-twenty-and-thirteen (quatre-vingt-treize) instead of ninety-three?

The advantages of the binary system are not as apparent as they seem, although the divisions of halves and quarters are a great convenience and probably always will be retained, as is the case with our decimal money. For the same reason every country adopting the metric system has temporized by employing halves and quarters of the metric denominations, especially the pint and pound, because these are nearly concordant with the half-liter and half-kilogram.

The lack of appreciation and consequent failure of a more rapid acceptance of the metric system in medicine arises principally from the fact that there is no metric unit corresponding with the minim and the grain. These two denominational units are the most natural and convenient for dosage of medicines. While not concordant, they are nearly so—the minim being about 5 per cent smaller than the grain, owing to the difference in the two ounces from which they are derived: the apothecaries' ounce containing 480 grains, while the fluidounce is equivalent to 456 grains of water.

The minim was designed to represent the drop, and while a drop of water under certain conditions is nearly equivalent to a minim, such conditions are not always attainable in practice; besides, with non-watery liquids the difference varies so greatly as to completely efface any similarity.

## ADAPTATION OF APOTHECARIES' WEIGHTS AND MEASURES TO THE METRIC SYSTEM.

Showing by cross-references the relative quantities of customary denominations in Metric Terms, based on the Metric Standard Liter and Gram.

| Decimal proportion. to 1 (Gm). | Denomination. | minim drop grain. | cubic Cm. Gram | fl. dram spoonful dram | centiliter. table spoonful. Dekagram. | fl. oz. ounce. | deciliter. Four-oz Hektagram. | Semiliter pint. Semi-kilogram pound. | Liter quart. Kilogram. | Abbreviations in order of preference. |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.001 | milligram. | 50 | 1.000 | 5.000 | 10,000 | 25,000 | 100,000 | 500,000 | 1 000,000 | cg; ctg; 0.01<br>These three denominations given only for reference. |
| 0.01 | centigram. | 5 | 100 | 500 | 1 000 | 2,500 | 10,000 | 50 000 | 100,000 | mg; 0.001..... |
| 0.1 | decigram. | 0.5 | 10 | 50 | 100 | 250 | 1 000 | 5,000 | 10,000 | dcg; dg; 0.1... |
| 0.05 | minim, drop grain. | 1 | 20 | 100 | 200 | 500 | 2,000 | 10,000 | 20,000 | m; mtm; min; gtt; 0.05 cc.<br>gr; mtgr; 5 cg; 0.05. |
| 1 | cubic cm. Gram. | 20 | 1 | 5 | 10 | 25 | 100 | 500 | 1,000 | cc; cm³; ccm; ml; 1 cc.<br>Gm; G; 1 0. |
| 5 | fl. dram. dram. | 100 | 5 | 1 | 2 | 5 | 20 | 100 | 200 | fldr; flmd; flmtd; met.spoonful; met.cochl; 5 cc.<br>mdr; mtd; metdr; 5.0. |
| 10 | centiliter. Dekagram. | 200 | 10 | 2 | 1 | 2.5 | 10 | 50 | 100 | cl; ctlit; met.tablespoonf'l; met.cochlmag.; 10cc<br>Dkg; Dekag; 10.0. |
| 25 | fl. ounce. ounce. | 500 | 25 | 5 | 2 5 | 1 | 4 | 20 | 40 | mfloz; met. floz; quaddcl; 25 cc.<br>moz; mtoz; quad Hkg; 25.0. |
| 100 | deciliter Hektogram. | 2,000 | 100 | 20 | 10 | 4 | 1 | 5 | 10 | dcl; decilit; flHk; flquatuncia; 100 cc.<br>Hk; Hkg; quatuncia; Four-ounce; 100.0. |
| 500 | Semi-liter. Semi-kilogm. | 10,000 | 500 | 100 | 50 | 20 | 5 |  | 2 | Smlit; mpt; ½ L: 500 cc.<br>Smkg: mpd; ½ K; 500.0. |
| 1000 | Liter Kilogram. | 20,000 | 1,000 | 200 | 100 | 40 | 10 | 2 | 1 | L; mqt; 1,000 cc.<br>K; Kg; 1,000.0. |

This adaptation is based upon the fact that 20 drops of water at 15° C, delivered from a minim pippette with an external diameter of 3 mm, will measure one cc.

The number of drops in the fluidram ranges from 25 of fixed oils to 300 or more of volatile liquids, such as chloroform. When a pipette is used for dropping the results are uniformly accurate, depending upon the outer diameter of the tube, the temperature and the rapidity of the operation. Thus it has been ascertained that a tube of 3 mm. outer diameter will deliver 20 drops of water at 15° C., which will measure 1 Cc. when dropped at the rate of one drop per second.

With 20 drops, equivalent to a cubic centimeter, instead of 16 drops, and assuming the Gram to contain 20 grains instead of 15.432 grains, we obtain at once these two essential denominational units as concordant and with the necessary decimal relation to the metric units, cubic centimeter and Gram, upon which a simple adaptation of the customary weights and measures may easily be constructed.

As will be observed, there are no changes whatever in the metric standards.

The new metric grain proposed is about one-fifth less than the troy grain.

The minim is a little less than one-fifth smaller.

The new Dram is about two-ninths greater than the apothecaries.

The new fluidram is about three-elevenths larger than the present fluidram.

Both Drams contain 100 grains or minims.

As is well known, the three ounces at present in use show this difference in the number of grains, each contains, viz.: apoth. or troy ounce, 480; fluidounce, 456; av. ounce, 437.5 grains.

The new ounces would be all alike, representing 25 Gm. or Cc., and would be from one-eighth to one-fifth less than the customary ounces.

The metric ounce, 25.0; one-fifth less than 1 apoth. ounce, 31.0.

The metric ounce, 25.0; one-sixth less than 1 av. ounce, 28.35.

The metric fl. ounce, 25.0; two-thirteenths less than 1 fl. ounce, 29.5.

The metric pint and pound are five to ten per cent greater respectively than the pint and avoirdupois pound.

The discrepancy in these two is not great, and would be readily adjusted. Each would contain 20 ounces, or 100 drams, or 10,000 grains, or minims.

The advantages of this adaptation for the calculation of doses, the strength of preparations, etc., is self-evident. The dose of an active agent in any quantity of a solution or mixture would have a definite decimal proportion and could be quickly calculated in metric grains, or minims. The smaller quantities represented by the proposed grain and minim would not be as objectionable as is the lack of proper relation between the present denominations,—a fruitful source of error in practice. Besides, the difference is on the safe side, and by employing the proper designations no mistakes could occur. The abbreviations of "Gm." for Gram should always be written with a capital G, to avoid confusion with "gr." for grain, which is never written with a capital letter. The Metric fluidram is especially designated "metric spoonful" to afford an accurate method for administration of liquid medicines. The ordinary teaspoonful is so variable in its measure as to be a travesty on dosage. Not only do the spoons vary widely in capacity, but the same spoon may hold as much again as its ordinary measure, according to the

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manner of pouring into it. After one fluidram has been filled into a spoon, another dram may be poured on top of the liquid without spilling.

The adoption of a definite spoonful measure would cause the domestic measurement of medicines by graduated measures exclusively. Of the centiliter, or tablespoonful, the same may be said. The decimal proportion of the ounces to the drams and also to the grain and minim would enable the prescriber to at once estimate the quantities and yet have the metric equivalents at a glance. The deciliter, or four-ounce, would be an exceedingly convenient quantity for extemporaneous prescription; containing 20 fl. drams it is well adapted to formulas of which the dose is a teaspoonful. For example: one grain at a dose; then 20 grains=1 Gm. to 100 Cc., or 4 fl. ozs.

In the belief that the adoption of some such adaptation, possibly as an appendix in the U. S. Pharmacopeia, would materially aid in the more general acceptance of the metric system for prescription writing, this scheme is now presented to the profession.

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